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EXPERIMENTAL INDUCTION OF THE "SENSED PRESENCE" IN NORMAL SUBJECTS AND AN EXCEPTIONAL SUBJECT[1]

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Summary.—9 of the 15 volunteers who were exposed to successive 3-min. durations of bursts of different types of weak (1 microT) complex magnetic fields or sham-fields reported the sense of a presence as indicated by a button press at the time of the experience. Reports of subjective experiences indicated that attempts to "focus" cognitively upon the location of the presence altered its location or induced its "movement." An exceptional subject who had a history of experiencing within his upper left peripheral visual field "flashing images" concerning the health and history of people [when handling their photographs] was also exposed to the burst sequences. Numbers of button presses associated with the experiences of a mystical presence, to whom the subject attributed his capacity, increased when the complex magnetic fields were applied without the subject's knowledge. The results support the hypothesis that the sense of a presence, which may be the common phenomenological base from which experiences of gods, spirits, angels, and other entities are derived, is a right hemispheric homologue of the left hemispheric sense of self.

The sense of a cognizant presence which is experienced as foreign or ego-alien to the experient can be considered the phenomenological basis for most reports of visitations by spirits, gods and extraterrestrial entities (Persinger, 1993). The working hypothesis is that this sense of "a presence" or extrapersonal incorporeal entity may be primarily the transient awareness of a right-hemispheric homologue of the left-hemispheric sense of self. The latter would be an artifact of the linguistic processes which involve traditionally left-hemispheric functions. Considering the structural similarity of the billions of brains which have constituted and presently compose the human species, the frequent historical occurrence and cross-cultural incidence of the sensed presence (Budden, 1994; Evans, 1984) are expected.

We have hypothesized that transient intercalations of neuroelectrical patterns between the two cerebral hemispheres, which allow the representation of the right-hemispheric equivalent of the sense of self into left-hemispheric awareness, are associated with the "sense of a presence." These periods of intercalation are more likely to occur during (1) dream sleep, (2) stress to the neuroelectrical substrate of the sense of self (the neurochemical

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correlates for which are enhanced release of corticotrophin releasing factor with concomitant activation of the limbic system and attenuation of the effects from gamma amino butyric acid within the cerebral cortices), (3) right-hemispheric hyperactivation, or (4) any experiences that encourage interhemispheric coherence such as Transcendental Meditation. These experiences can be encouraged by (1) transient, functional alterations in synaptic patterns following many closed-head injuries if the integrity of reciprocal collaterals through the corpus callosum or dorsal hippocampal commissure has been disrupted by shearing forces (Persinger, 1994) and (2) the more temporally stable microstructural factors associated with sex (normal women) and (left) handedness.

Previous experiments have suggested that bilateral presentation of weak, complex magnetic fields across the left and right temporoparietal lobes increased the probability that this intercalation might occur. The most optimal fields have been those which imitate the "burst-firing" patterns of amygdaloid-hippocampal neurons (Richards, Koren, & Persinger, 1992). That temporoparietal electrical process may be necessary for the experience of the sensed presence has been suggested for patients who have sustained mild to moderate closed-head injuries as defined by a thorough neuropsychological assessment. In an unpublished study (Persinger & Tiller) patients who reported recurrent episodes of sensed presences differed from those who did not by a significantly increased speed in the haptic discrimination for the left hand during the Tactual Performance Test (despite normal scores for the dominant right hand). If the numbers of complex partial epileptic symptoms (Persinger & Makarec, 1993) were first removed by covariance for the left-handed latencies, this group difference for haptic discrimination was no longer statistically significant.

The present experiments were designed to discern whether specific patterns of complex, weak magnetic fields over the left, right, or both hemispheres would evoke the experiences of a presence during the progressive presentation of various stimulus patterns. We have found that successive presentations of several wave envelopes with different biorelevant shapes appear to facilitate resonant interaction between the brain and the applied field (Persinger, Richards, & Koren, 1997); however, until the mechanism can be defined mathematically this explanation is considered metaphorical.

The first experiment involved exposure to two patterns considered minimally effective and two patterns considered maximally effective. Ineffective patterns are sinusoidal or structurally redundant sequences while effective patterns are temporally anistropic and contain biorelevant information within the wave structure or envelope. One of these patterns, burst-firing (cf. diagram in Richards, *et al.*, 1993), has been shown to evoke a sensed presence during the presentation while the second which is known to evoke

long-term potentiation in hippocampal slices (see Richards, *et al.*, 1996) was expected to produce effects after its termination due to a "release phenomenon" or rebound effect.

The second experiment involved exposures of these fields to an exceptional subject. During this experiment, we employed a specific pattern designated as the Thomas pulse (patent pending) which has been shown to affect the responses of opiate receptors in snails (Thomas, Prato, & Kavaliers, 1996) and to evoke significant vestibular experiences in human beings who were (initially) not aware of the field's presence (A. W. Thomas, private communication, 1996). These reports were considered relevant in light of the association between vestibular sensations and complex partial epileptic-like signs (Persinger & Makarec, 1993) and the contiguity of these experiences with the sense of a presence, enhanced geomagnetic activity, and reports of postmortem apparitions (Persinger, 1988; Persinger & Richards, 1995). Given the results of Exp. II, Exp. III was completed to discern whether the Thomas pulse evoked comparable changes in normal volunteers.

Method

Subjects

In Exp. I, six men and nine women, 21 to 23 years of age, volunteered as subjects. They had been enrolled in a first-year psychology course and obtained 2% bonus marks for their participation. The exceptional subject, a 56-yr.-old male, was the only subject in Exp. II. He reported a long history of displaying unusual accuracy for hidden objects and for discerning the medical and physical history of people by ostensibly employing the visual and tactile information obtained from their recent photographs. The experiences were described as "brief flashes" within the upper-left peripheral visual field. The occurrence and accuracy of these experiences were attributed by the exceptional subject to multiple presences, including a religious entity. He had been successfully self-employed for several years as a psychic or sensitive. Seven volunteers (4 women, 3 men), ages 20 to 22 years, served as subjects in Exp. III. The university subjects were given a 1% bonus mark for the final mark for a psychology course in which they were enrolled.

Procedure

The subject was asked to sit quietly in a comfortable chair housed within an acoustic chamber. The eyes were covered with a small mask. The subject was told that he could push a button if a presence was felt. The subject was instructed to press either the left- or right-hand button if a presence, like someone in the room, was felt on the left or right side, respectively. If the presence was along the back, both buttons were pushed. The occurrence of the button responses and verification of the field presentation

from a sensor near the solenoids generating the fields were measured by continuous strip-chart recording.

In Exp. I, each subject wore a modified helmet within which four sets of solenoids were embedded (Richards, Persinger, & Koren, 1993, 1996). They generated 5 microT fields at 1 cm from the source and 1 microT within 4 cm of the source (within the cortical depth). The wave patterns were generated by a series of numbers between 0 and 255 that were transformed from digital to analogue values and amplified. Each of the 10 subjects was exposed twice without interruption to the following sequence of field patterns. These were no pulse, 3.3-Hz sine-wave, no pulse, long-term potentiating pulse (Richards, *et al.*, 1996), no pulse, 1.6-Hz sine wave, no pulse, and the burst-firing pattern (Richards, *et al.*, 1992). The duration of the no-pulse interval was 3 min. while the field intervals were 2.5 min. The interstimulus presentation (time between envelopes) was 4 sec. and the duration of each point (the number between 0 and 255) that composed the sequence of numbers that generated the wave shape was 3 msec. Real time disk-to-port latency for each pixel was 190 microsec.

Ten of the 15 subjects reported a presence as defined by button presses. The presentation mode had been bilateral or over both hemispheres ($n = 4$), right hemisphere ($n = 3$), and left hemisphere ($n = 3$). Multiple regression applied to the numbers of button responses (presences) per 20 sec. (one strip chart length) were analyzed as a function of each of five field patterns computed as dummy variables. Stated alternatively, the cases were numbers of button presses per 20-sec. increment. To discern the lag or delayed effects predicted, 10 lag variables (3 min.; 20 sec.) after the field onset were calculated.

In the first phase of Exp. II, the exceptional subject was exposed to the same setting and to the same sequence of patterns to which the normal volunteers had been exposed; however, the fields were applied bilaterally from two containers that were attached to each temporoparietal region of the scalp by velcro straps (Baker & Persinger, 1996). The field strengths at the distances of the upper layer of the cortices were between 0.5 and 1.5 microT. The subject was given the same instructions (Exp. I) with respect to registering the lateralization of the sensed presences.

During the second phase of this experiment, the subject was exposed to a single series of presentations of the Thomas pulse. This pulse, which can be characterized visually as 18 clusters of rapid variations (1 to 2 msec.) with two complete polarity shifts per cluster and gradually increasing intervals between clusters, was presented four times, 5 min. each, with a 3-min. period of no field between each presentation. The duration of each pixel of the 849 sequential points (the values between 0 and 255 that are transformed to voltages) was 1 msec. and the time between presentations of each envelope

(one complete Thomas pulse) for each 5-min. exposure were 3 msec., 33 msec., 330 msec., and 3000 msec. These values were selected on the basis of Thomas' theoretical calculations (Kavaliers, Prato, & Thomas, 1996; Thomas, Prato, & Kavaliers, 1996). The mean numbers of button presses per minute indicating a sense of presence on the left side, right side, or behind the subject during the field and no-field presentations were calculated. Chi-squared analyses were calculated manually and separately for each phase of the experiment.

Given the strong effects of the Thomas pulse for the elicitation of responses associated with the sense of a presence, we predicted that normal subjects should also experience the sense of presence more frequently when these particular pulse parameters were delivered. Consequently, the effect size would be much larger, and fewer subjects would be required to achieve statistical significance. Only four (two men, two women) of the seven subjects reported repeated and strong sensations of a presence. Paired t tests were completed to judge whether differences were significant between the numbers of responses during the presence or absence of the Thomas pulse. To indicate whether any particular parameter was more effective for evoking the experiences, multiple regression analysis was completed. Each 20-sec. increment served as a case and the four different intervals for interenvelope presentations were computed as dummy variables. SPSS software was employed.

The total experimental time per subject ranged between 45 and 50 min. All testing occurred during the evening, between 1800 and 2200 hr. During the day of and the day before the exposures the daily global geomagnetic activity, as inferred by the A values from Fredericksburg, Virginia, did not exceed 20. Stated alternatively, the global geomagnetic activity was within the quiet to very quiet range. Accommodation for ambient global geomagnetic activity was considered relevant since reports of vestibular experiences increase significantly in our experimental setting if the daily aa (average antipodal) global geomagnetic activity exceeds about 20 nT (Persinger & Richards, 1995).

Results

Quantitative Analyses

Multiple regression analysis for all 10 subjects showed a significant relationship between the numbers of button presses and the field presentations. The multiple R was .31 ($F_{2,116} = 6.13$, $p < .01$). The partial regression coefficients for the equation were .81 for the seventh lag of the LTP pulse and .52 for the second lag after the onset of the burst (constant = 0.26). The four subjects who received bilateral stimulation showed a conspicuous increase in the numbers of felt presences within the first 2 min. following the offset of

the pattern of long-term potentiation ($r = .40$). For comparison the most frequent button presses occurred during the burst-firing field, $M = 0.21$/min., $SD = 0.31$, while the fewest occurred during the presentation of the long-term potentiating field ($M = 0.04$, $SD = 0.10$).

We then analyzed the orthogonal arrangement of data whereby the subjects were the cases and the number of button presses per min. were the dependent variables. To discern if the enhancement of sensed presences during the burst firing presentation but after the LTP pattern was still evident, the ratio of button presses during the presentation was divided by the numbers during the interval immediately after the presentations. The mean and standard deviation for these ratios for the burst firing pattern were 1.2 and 0.2 and for the LTP pulse were 0.8 and 0.3. A paired t test ($t_9 = 2.66$) indicated that this effect was statistically significant ($p < .05$).

The results for the exceptional subject were conspicuous visually. The average numbers of button presses per min. (rounded to the nearest whole number) during the 3.3-Hz, LTP, 1.6-Hz and burst-firing pattern were 12, 22, 8, and 7, respectively. The responses during the no-field conditions ranged between 5 and 10 presses per min. Chi-squared analysis ($\chi_6^2 = 34.81$, $p < .01$) indicated a significant disconcordance from chance (averaged) expectancy which was due primarily to the enhanced experiences during the LTP presentations.

The results of exposure to the different temporal parameters of the Thomas pulse are shown in Fig. 1. Given the specificity for localization, the chi-squared analysis was completed for the numbers of sensed presences along the left side, right side, or behind the subject during the field presentation relative to no field conditions. There were disproportionately more experiences of ($\chi_2^2 = 25.89$, $p < .01$) sensed presences directly behind the subject when the field was generated through the temporoparietal lobes relative to the no-field periods.

The results of Exp. III that involved only four subjects were also clear. A paired t test indicated that during the field presentations the mean numbers of presences ($M = 0.7$, $SD = 0.7$) per min. was significantly higher ($t_3 = 3.27$, $p < .05$) than during the no-field ($M = 0.5$, $SD = 0.7$) intervals. The results of the multiple regression analysis, which employed the mean numbers of sensed presences for all subjects as the dependent variable and the four different field parameters as the independent variable, indicated that presentation of the Thomas pulse once every 330 msec. (1-msec. pixel durations) was the only single, significant ($F_{1,107} = 9.40$, $p < .01$) variable to predict the numbers of sensed presences ($MR = 0.28$).

Subjective Experiences and Phenomenology

Sample subjective experiences may be illustrative. One female, who re-

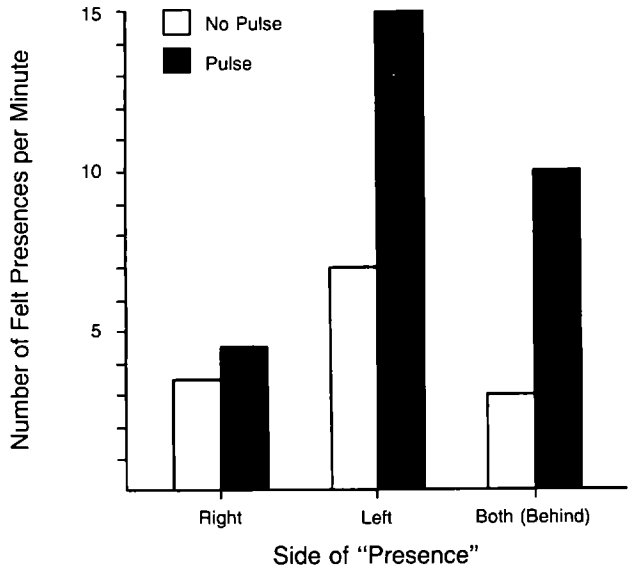

FIG. 1. Numbers of sensed presences per min. along the left side, right side, or behind the exceptional subject during periods of no field or periods of exposures to weak, complex pulsed fields across the temporoparietal lobes

ceived the batch sequence from Exp. I over the right hemisphere reported several, distinct episodes of a presence primarily caudally and along the left side. She reported a "feeling of rising" or a detachment of the self. She felt as if she were floating but something like a thread was restraining her movement upwards. After the session was terminated she experienced a sense of "overwhelming weirdness"; however, she requested a second experience.

A second female subject from Exp. I reported multiple episodes (during the same experiment) of a presence primarily behind her and along the left side. She also received the stimulation over the right hemisphere. When the experient attempted to focus upon the location of the presence, it moved. At times she felt that if she had opened her eyes, the presence would be immediately in front of her face. Apprehension was significant. She decided to stop pressing the buttons and to ignore the presence. The most typical theme of the descriptions during exposures to the Thomas pulse was unpleasant vibrations moving through the body.

DISCUSSION

The results for the normal volunteers support the previous studies that the sense of a presence can be experimentally induced when weak, complex magnetic fields (with wave profiles) were predicted by theory to enhance the intercalation of hemispheric neuroelectrical patterns when they are applied

across and through the temporoparietal lobes. A specific temporal structure, described as "burst firing," generated increased incidences of sensed presences during its presentation. This burst-firing signature has been employed in our previous studies and is known to elevate the nociceptive thresholds in rats with histories of limbic lability (Fleming, Persinger, & Koren, 1994) and to evoke "pleasant feelings" in human beings (Freeman & Persinger, 1996). The digital sequences from which this wave structure was created were extracted from the signature of a population of amygdaloid neurons from the brain of a patient diagnosed with complex partial epilepsy.

The present experiment also indicated a pattern that evokes long-term potentiation in hippocampal slices and enhanced long-term memory consolidation in humans (Richards, *et al.*, 1996) may also facilitate these experiences; however, these occurred following the cessation of this specific field. Although the precise mechanism is not clear, we suspect that some pulses may produce immediate coherence between the left- and right-hemispheric representation of the sense of self and the sense of a presence while others may facilitate this intercalation during compensatory rebound activation that follows their inhibitory effects. Our explanation is that stimulation of subcortical electrical properties, such as long-term potentiation within the hippocampal system, by the pulse inhibits this system which then displays brief compensatory activation that increases the potential coherence and hence intercalation between the two hemispheres. This vertical activation of the right temporoparietal region by enhanced subcortical activity within the hippocampal-amygdaloid complex (which intercalates with left-hemispheric processes) would be consistent with other observations that the sense of a presence is associated with complex partial epileptic-like symptoms (Persinger & Makarec, 1993).

The energetic requirements for both generating the critical pattern of neural activity within the right hemisphere for most individuals and the intercalation between the two hemispheres are not expected to be extreme. Both Positron Emission Tomography and functional Magnetic Resonance Imaging are computerized reconstructions of the general metabolic activity, uptake capacity for isotopes, or atomic spin characteristics for millions of neurons within a region. Like indices of geomagnetic activity which indicate the average amplitude of perturbations but not the subtle, complex temporal characteristics or spectral dimensions (which *are* the information within the system) of those changes, PET and fMRI do not discriminate the critical temporal pattern of neuronal sequences with which consciousness and its variant states are expected to be associated.

The phenomenology associated with the experiences of a sensed presence in these subjects indicates that "thought" and "intent" can alter the neurocognitive matrices or the nodal positions within "neural nets" with

which the sense of presence was correlated. Reports that the "presence moved" to the opposite side or to a position behind the experient when the experient attempted to "focus" upon the location suggests the subtlety of the effect as well as its interaction with normal cognition. From this context the subjective conviction that the "presence" responds to one's thoughts or intentions and is an independent, sentient and even cognizant entity, e.g., angels, spiritual creatures, might be explained from a different perspective.

Although we have pursued the hypothesis that the sense of a presence originates within primarily right-hemispheric processes in most people, the idea is not novel. More than one hundred years ago, Frederick Myers (1885) suggested a "subliminal self"—perhaps the analogue of the hidden observer proposed as an explanation for certain hypnotic phenomena, displayed a primary focus within the right hemisphere. Assuming total validity of the experiences of his mediumistic subjects, Myers assumed that this right-hemispheric self accessed paranormal and spiritual realms. The propensity for "spiritual" phenomena, such as apparitions and rappings, to occur along the left side of the medium's body was considered supportive of a "right-hemispheric" source of psychical experiences (Harrington, 1995). These astute observations and ideas appear to have been ignored or forgotten. The present methodology and technology may allow the complete or partial refutation or support for these interesting nineteenth century concepts.

The experimental facilitation of the numbers of sensed presences for an exceptional subject suggests that a process similar to the one generating his persistent feeling of a "guiding presence" may be triggered by the application of weak, complex magnetic fields. Unlike the normal volunteers in Exp. I, however, this subject perceived the presences primarily during the presentation of the pulses that evoke long-term potentiation. The immediacy rather than the latency of the experience of a presence might indicate a significantly different microstructural organization of this subject's brain. We hypothesize that inhibitory mechanisms which filter the massive, potential visuospatial input of information into the brain from normal exogenous sources were minimally operative for this subject. His personal experiences of "inundation by visual images like rapid film clips" would be consistent with this suggestion. The localization within the upper-left peripheral visual field suggests an electrical focus within the right occipitotemporal region or involvement of Meyer's loop.

It may be relevant that the special subject's neuropsychological profile suggested chronic hypofunction for spatial memory and spatial orientation (a right superior parietal anomaly) in conjunction with indicators of mild left temporooccipital deficits. The most parsimonious explanation would require an anomalous coupling between the right entorhinal-hippocampal formation and its projection to areas within the temporal cortices that facilitates mini-

mally inhibited information to be transmitted through the dorsal hippocampal commissure and adjacent corpus callosum into the left temporoparietal region. The experience of incomplete transformation of right-hemispheric processes into left-hemispheric linguistic codes might be perceived as "ego-alien" or even extracorporeal. If the area of hypofunction within the right superior parietal region was associated with brief hyperfunction during his periods of "visuospatial images," then source of the information might originate from this region and anomaly.

The exceptional subject also responded strongly and differentially to the Thomas pulse. The largest numbers of presences were reported to have occurred along his left side, were associated with fear and unpleasantness and occurred when the subject received the Thomas pulse at parameters that are known to evoke unpleasant dizziness and vertigo in some normal subjects (A. W. Thomas, private communication). From this context, the association with right-hemispheric activation and dizziness in patients who display panic attacks and the contribution from ambient weak magnetic fields to the recent epidemic of "visitor experiences" might be re-evaluated (Budden, 1994).

The elicitation of the more frequent responses of a sensed presence in normal subjects by the application of the Thomas pulse suggest the greater potency of this wave structure. Unlike the burst-firing pattern, however, which has been associated primarily with pleasant experiences, except when applied over the right caudal hemisphere for right-handed women (Richards, *et al.*, 1992), bilateral application of the Thomas pulse was associated with either neutral or negative experiences. Reports of *unpleasant* vibrations moving through the body were novel and specific to this pulse form. This same pulse has been known to evoke shivering, coldness, the sensation of a "bright white light" that fills awareness and a sense of impending death particularly if the subject has been exposed to nociceptive stimuli or contexts that would be expected to elevate corticotrophin releasing factor or initiate altered blood flow within distal branches of the two Posterior Cerebral Arteries.

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